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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/825,070	04/03/2001	Timothy G. Adams	50654	1972

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BOSTON, MA 02209

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EXAMINER

LEE, SIN J

ART UNIT	PAPER NUMBER
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1752

DATE MAILED: 07/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

09/825,070

Examiner

Sin J Lee

Applicant(s)

ADAMS, TIMOTHY G.

Art Unit

1752

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 17-27 and 32-53 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 17-21, 24-27 and 32-44 is/are allowed.
- 6) ☒ Claim(s) 45-47, 49, 50, 52 and 53 is/are rejected.
- 7) ☒ Claim(s) 22, 23, 48 and 51 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 11.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. Applicant canceled claim 31.
2. Applicant recites in claim 17, “the photoresist composition comprising a photoactive component and a polymer that comprises 1) groups reactive to crosslinking; 2) photoacid-labile groups; and 3) a thermal acid generator compound.” Based on the reading of present specification (pg.4, lines 22-28, pg.12, lines 24-29), the Examiner interpreted the claim 17 language as a photoresist composition comprising a photoactive component, a thermal acid generator compound, and a polymer that comprises groups reactive to crosslinking and photoacid-labile groups. The Examiner would like to recommend applicant to delete “3)” in order to clarify that the thermal acid generator compound is a component of the photoresist composition, not a group that is attached to the polymer.
3. In view of the amendment filed on May 19, 2003, the previously made rejections on claims 17-27 and 31-38 over Watanabe et al’665 in view of Jeoung et al’672 are hereby withdrawn. Watanabe in view of Jeoung does not disclose nor suggest the use of the presently required thermal acid generator of claims 17 and 37. Also, Watanabe’s polymer contains substantial amount of aromatic groups, and thus the reference does not teach present polymer of claim 45 which is substantially free of aromatic groups.
4. Claims 22-23 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the

claim(s) in independent form. In claim 22, applicant recites that the substrate comprises one or more contact holes. However, the substrate claimed in present claim 17 already comprises one or more contact holes.

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Claim Rejections - 35 USC § 103

6. Claims 45-47, 49, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (EP 0 939339 A1) in view of Jeoung et al (6,358,672 B2) (with Yamada (6,241,857 B1) which is being cited here to support the Examiner's position that it is well known in the art that typically in a semiconductor device, a contact hole is formed in an interlayer insulating film on a semiconductor substrate to connect a semiconductor element and wiring).

Chen teaches (see col.1, lines 5-10, col.3, lines 32-37) a light sensitive positive-tone resist material containing a photoacid generator and a dual protected polymer resin which comprises an aqueous base soluble polymer resin having polar functional groups thereon, wherein some of the polar functional groups are protected with at least two different acid labile protecting groups. As examples for the aqueous base soluble polymer resin having polar functional groups, Chen teaches (col.3, lines 51-58) polyhydroxystyrene, phenol formaldehydes, polyacrylic acid or polymethacrylic acid, acrylamide, imide, or hydroxyimide group type polymers. Since there are only several examples to choose from, it would have been obvious to one of ordinary skill in the art to choose polyacrylic acid or polymethacrylic acid as Chen's aqueous base soluble polymer resin having polar functional groups (the polar functional groups in this case would be carboxyl groups, some of which will be dually protected with at least two different acid labile protecting groups) with a reasonable expectation of obtaining a resist material exhibiting high resolution and good environmental stability. Chen teaches (see [0023]) that suitable acid labile protecting groups include high activation energy protecting groups, low activation energy protecting groups, or mixtures thereof, and Chen furthermore states that it is within the scope of his invention to use *only* high activation energy protecting groups or *only* low activation energy protecting groups to dually protect his polymer resin. Therefore, based on Chen's teaching, it would have been obvious to one of ordinary skill in the art to dually protect Chen's poly(meth)acrylic acid resin with two different low activation energy protecting groups with a reasonable expectation of obtaining a resist material exhibiting high resolution and good environmental stability. As examples of low activation energy protecting groups that can be

used in his invention, Chen teaches (col.5, lines 26-41) tetrahydrofuranyl, tetrahydropyranyl, methoxycyclohexanyl, methoxycyclopentanyl, cyclohexanyloxyethyl, ethoxycyclopentanyl, ethoxycyclohexanyl, methoxycycloheptanyl, and ethoxycycloheptanyl. Since there are not that many examples to choose from, it is the Examiner's position that it would have been obvious to one of ordinary skill in the art to dually protect Chen's poly(meth)acrylic acid resin with tetrahydrofuranyl group and methoxycyclohexanyl group with a reasonable expectation of obtaining a resist material exhibiting high resolution and good environmental stability. The portions of poly(meth)acrylic acid resin protected with tetrahydrofuranyl group will result in secondary acetal groups whereas the portions of poly(meth)acrylic acid protected with methoxycyclohexanyl group will result in *tertiary acetal groups (present group reactive to crosslinking as recited in claim 50)*. Therefore, Chen's teaching would render obvious present photoresist composition of claim 45.

Chen applies (see [0050]) his resist material to a silicon wafer and performs a baking step. Then, the resist film is exposed to deep UV light and then developed. Chen does not teach presently claimed step of thermally treating the developed photoresist layer to induce crosslinking of the photoresist components. Jeoung et al teach (col.4, lines 20-24) a method of forming a semiconductor device pattern through the formation of a uniform and a desired size of a contact hole pattern by applying a flow method for a deep UV photoresist. According to Jeoung's invention (col.6, lines 41-40), a developed photoresist pattern on a semiconductor wafer is irradiated with UV light after the developing process in order to make less critical dimension

so that the distortion of the photoresist pattern during a flow process is prevented, and a desired pattern size can be effectively achieved. Jeoung's UV bake unit (see col.7, lines 24-29) includes a UV lamp for providing a UV light, and a hot plate for mounting a wafer with a distance from the UV lamp and *heating* the wafer. When the wafer is transferred into the UV bake unit after the developing process, UV light irradiation on the photoresist pattern and the bake process on the hot plate are carried out (col.8, lines 16-23) so as to cause the *crosslinking reaction* inside the photoresist and the *flow process* simultaneously, and thereby achieve the smaller size of photoresist pattern than pattern after the development. Based on Jeoung's teaching, it would have been obvious to one of ordinary skill in the art to apply Jeoung's teaching to Chen's invention and carry out a UV baking step after developing Chen's pattern so as to induce crosslinking reaction inside Chen's photoresist and the flow process simultaneously in order to effectively achieve a desired pattern size as taught by Jeoung. Therefore, Chen in view of Jeoung would render obvious present inventions of claims 45-47, 49, and 50. With respect to present limitation "microelectronic substrate that comprises one or more contact holes", although Chen does not explicitly mention the presently claimed contact holes, it is the Examiner's position that it is implied that Chen's semiconductor substrate contains one or more contact holes because typically in a semiconductor device, a through-hole (or contact hole) is formed in an interlayer insulating film on a semiconductor substrate to connect a semiconductor element and wiring as evidenced by Yamada, col.1, lines 18-22.

7. Claims 52 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (EP 0 939339 A1) in view of Jeoung et al (6,358,672 B2), and further in view of Garofalo et al (5,338,626).

With respect to present claims 52 and 53, Chen teaches (col.1, lines 5-9) that his resist material can be used with deep UV ray lithography. Deep UV ray lithography typically involves using light with wavelength of 248 nm or 193 nm as evidenced by Garofalo et al, col.5, lines 47-48. Therefore, based on the teaching of Chen in view of Garofalo, it is the Examiner's position that it would have been obvious to one of ordinary skill in the art to use a light having wavelength of 193 nm to expose Chen's resist film.

Therefore, Chen in view of Jeoung and further in view of Garofalo would render obvious present inventions of claims 52 and 53.

Allowable Subject Matter

32 S.T.L.

8. Claims 17-21, 24-27, ~~31~~³²-44 are allowed. Claims 48 and 51 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

As explained above, Watanabe'665 in view of Jeoung'672 does not disclose nor suggest the use of the presently required thermal acid generator of claims 17 and 37. Also, Chen (EP'339) in view of Jeoung'672 does not disclose nor suggest the use of the presently required thermal acid generator of claims 17, 37, and 51. Chen in view of Jeoung does not disclose nor suggest the presently claimed photoacid labile groups of claim 48 which are primary acetal

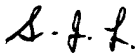
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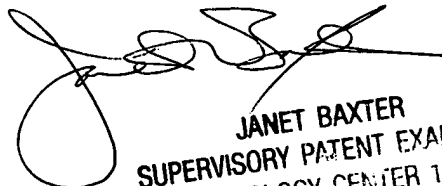
groups. Sinta et al (6,033,830) teaches the use of a thermal acid generator and a photoacid generator together in an antireflective composition. However, the resin binder used in the antireflective composition does not teach or suggest the present polymer that comprises groups reactive to crosslinking and photoacid labile groups as presently claimed in claims 17, 37, and 45.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is (703) 305-0504. The examiner can normally be reached on Monday-Friday from 8:30 am EST to 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ms. Janet Baxter, can be reached on (703) 308-2303. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9311 for after final response or (703) 872-9310 for before final responses.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0661.


S. Lee
July 19, 2003


JANET BAXTER
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